

**WHAT IS CLAIMED IS:**

1 ~~1~~ A circuit arrangement for controlling audio signal transmissions for a  
 2 communications system that includes a microphone and a video camera, comprising:  
 3 a video processor configured and arranged to receive a video signal from the  
 4 video camera, detect movement of an object in the video signal, provide a motion-  
 5 indicating signal indicating movement relative to the object; and  
 6 an audio processor coupled to the video processor and configured and arranged to  
 7 modify the audio signal to be transmitted responsive to the motion-indicating signal.

1 2. The circuit arrangement of claim 1, wherein the object is a person.

1 3. The circuit arrangement of claim 1, wherein the object is a person's face.

1 4. The circuit arrangement of claim 1, wherein the object is a person's mouth.

1 5. The circuit arrangement of claim 1, wherein the audio processor is configured and  
 2 arranged to ~~mute~~ the audio signal to be transmitted responsive to the motion-indicating  
 3 signal.

1 ~~5~~ 5. An echo-cancellation arrangement for a video communication system that  
 2 includes a microphone, a speaker, and a video camera for use by a video conference  
 3 participant at a first location, comprising:  
 4 a video signal processor configured and arranged to receive a video signal from  
 5 the video camera, detect mouth movement of the participant and provide a mouth-  
 6 movement signal indicative of movement of the participant's mouth;  
 7 an echo-cancellation circuit coupled to the video signal processor and configured  
 8 and arranged to filter from an audio signal provided by the microphone sound energy  
 9 output by the speaker responsive to the mouth-movement signal.

1 ~~6~~ 6. The arrangement of claim ~~5~~ 5, wherein the video signal processor includes:

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2 a background detector configured and arranged to distinguish a foreground  
3 portion of an image from a background portion of the image;

4 a face detector coupled to the background detector and configured and arranged to  
5 detect an image of the participant's face in the foreground portion and detect movement  
6 of the participant's face; and

7 a mouth-movement detector coupled to the face detector and configured and  
8 arranged to detect mouth movement in the image of the face and provide the mouth-  
9 movement signal.

1 ~~8~~<sup>7</sup> The arrangement of claim ~~6~~<sup>5</sup>, wherein the echo-cancellation circuit includes:  
2 a double-talk detector configured and arranged to detect and generate a double-  
3 talk signal in response to a received audio signal and a transmit audio signal;

4 a coefficient adapter coupled to the double-talk detector and to the video signal  
5 processor and configured and arranged to generate filter coefficients responsive to the  
6 double-talk and mouth-movement signals; and

7 a filter coupled to the adaptive processor.

1 ~~9~~<sup>8</sup> A video communication arrangement with video-assisted echo-cancellation, the  
2 arrangement for use by a video conference participant at a first location, comprising:

3 a microphone;

4 a speaker;

5 a video camera arranged to provide a video signal;

6 a video signal processor coupled to the video camera and configured and arranged  
7 to detect mouth movement of the participant in the video signal and provide a mouth-  
8 movement signal indicative of the participant speaking;

9 an echo-cancellation circuit coupled to the microphone, speaker, and video signal  
10 processor and configured and arranged to filter, responsive to the mouth-movement  
11 signal, from an audio signal provided by the microphone sound energy output by the  
12 speaker;

13 a video display device;

14 a channel interface;

15 a multiplexer coupled to the channel interface, the echo-cancellation circuit, and  
 16 the video signal processor, and configured and arranged to provide audio and video  
 17 signals as output to the channel interface; and

18 a demultiplexer coupled to the channel interface, the echo-cancellation circuit, the  
 19 video display device, and the speaker, and configured and arranged to provide audio and  
 20 video signals.

1 <sup>9</sup> 9. The arrangement of claim <sup>8</sup> 8, wherein the video signal processor includes:

2 a background detector configured and arranged to distinguish a foreground  
 3 portion of an image from a background portion of the image;

4 a face detector coupled to the background detector and configured and arranged to  
 5 detect an image of the participant's face in the foreground portion and detect movement  
 6 of the participant's face; and

7 a mouth-movement detector coupled to the face detector and configured and  
 8 arranged to detect mouth movement in the image of the face and provide the mouth-  
 9 movement signal.

1 <sup>10</sup> 10. The arrangement of claim <sup>9</sup> 9, wherein the echo-cancellation circuit includes:

2 a double-talk detector configured and arranged to detect and generate a double-  
 3 talk signal in response to a received audio signal and a transmit audio signal;

4 a coefficient adapter coupled to the double-talk detector and to the video signal  
 5 processor and configured and arranged to generate filter coefficients responsive to the  
 6 double-talk and mouth-movement signals; and

7 a filter coupled to the adaptive processor.

1 <sup>11</sup> 11. The arrangement of claim <sup>10</sup> 10, wherein the echo-cancellation circuit includes:

2 a double-talk detector configured and arranged to detect and generate a double-  
 3 talk signal in response to a received audio signal and a transmit audio signal;

4 a coefficient adapter coupled to the double-talk detector and to the video signal  
 5 processor and configured and arranged to generate filter coefficients responsive to the  
 6 double-talk and mouth-movement signals; and

7 a filter coupled to the adaptive processor.

1 ~~13.~~ A method for audio signal and video signal processing, comprising:  
 2 receiving a video signal from a video camera;  
 3 receiving an audio signal from a microphone;  
 4 detecting movement of an object in the video signal;  
 5 providing a motion-indicating signal to an audio signal processor when movement  
 6 of the object is detected;  
 7 modifying the audio signal in response to the motion-indicating signal.

1 ~~14.~~ The method of claim ~~13~~<sup>13</sup>, wherein the object is a person.

1 ~~15.~~ The method of claim ~~13~~<sup>14</sup>, wherein the object is a person's face.

1 ~~16.~~ The method of claim ~~13~~<sup>15</sup>, wherein the object is a person's mouth.

1 17. The method of claim 13, wherein the object is a person's mouth.

1 18. The method of claim 13, further comprising providing a muted audio signal when  
 2 no motion is detected.

1 ~~19.~~<sup>16</sup> A method for audio signal and video signal processing, comprising:  
 2 receiving a video signal from a video camera;  
 3 receiving an audio signal from a microphone;  
 4 detecting movement of a person's mouth in the video signal;  
 5 providing a motion-indicating signal to an echo-cancellation circuit when  
 6 movement is detected; and  
 7 modifying filter coefficients in response to the motion-indicating signal.

1 ~~20.~~<sup>17</sup> The method of claim ~~19~~<sup>16</sup>, further comprising:  
 2 detecting a foreground portion of an image in the video signal;

3 detecting a face in the foreground portion of the image; and  
4 detecting a mouth on the face.

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1 ~~21.~~ An apparatus for audio signal and video signal processing, comprising:  
2 means for receiving a video signal from a video camera;  
3 means for receiving an audio signal from a microphone;  
4 means for detecting movement of a person's mouth in the video signal;  
5 means for providing a motion-indicating signal to an echo-cancellation circuit  
6 when movement is detected; and  
7 means for modifying filter coefficients in response to the motion-indicating  
8 signal.

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